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Marine Physical Laboratory

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Development and Testing of a Drill Hole Instrument Placement System

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Principal Investigator: F. N. Spiess

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Development and Testing of a Drill Hole Instrument Placement System

F. N. Spiess, (University of California, San Diego, Scripps Institution of Oceanography, A-030, La Jolla, CA 92093; 619-534-1621)

Over the last four years a pilot version of a wireline entry system has been developed and used at three northwestern Atlantic DSDP sites (417D, 418A, 534A). The system is based on use of standard 0.68" electromechanical cable and has the capability of carrying out location and simple reconnaissance logging of deep sea boreholes and for installation and telemetry involving more complex downhole payloads (e.g. an array of four three-component geophones) from ships of the academic research fleet (e.g. KNORR, MELVILLE).

In its simplest form it consists of a thruster package connected to the 0.68" wire with a logging tool suspended below it by a length of electromechanical cable appropriate to the desired downhole penetration of the tool. The thruster provides means for local control of horizontal displacement, and contains a sonar used for location of the re-entry cone during an initial lowering without the logging tool. It can interrogate and listen to the transponders in the long baseline acoustic system that provides primary ship and instrument tracking. The logging tool has a down-looking TV camera, lights, hydrophone to receive navigation signals, an upper and lower caliper, two component tilt measurement, temperature and pressure sensors. The first two deployments (holes 417 and 418) demonstrated our ability to locate the re-entry cones and to control and monitor the position, relative to the cones, of the tool hanging 200m below the thruster. In both cases, however, the holes were blocked, in the bottom of the cone, by mud of sufficient thickness to prevent the 50 kg tool from penetrating more than a few meters. Subsequent examination of the recovered sediment led to the conclusion that it had oozed up from below the casing (30m and 70m for the two holes). Hole 534 (cased to 530m) was clear, the logging tool was lowered 150m down the hole, and a proper logging pass was made up to the sea floor. To that depth the cased hole, as expected, was of uniform cross section and did not deviate from vertical by more than 1.5°. Most remarkably, the temperature just inside the hole was 4°C (ambient seawater 2°C), increasing to 8° at 150m, giving clear indication of upward flow of water in the hole. In subsequent operations a second entry was made installing a downhole geophone array and in-cone recording package described in another paper (*Stephen et al.*) at this meeting.

Although a number of system modifications to improve reliability and maneuverability are indicated, nevertheless, the feasibility of a simple, direct approach to the problem of hole re-entry from an oceanographic ship has been demonstrated.

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